

Claims

What is claimed is:

1. A device for measuring the auto-fluorescence of a retina comprising:
an excitation light source adapted to provide an excitation light at a wavelength corresponding to excitation of flavoprotein auto-fluorescence; and
an image capture device adapted to record a single image representative of a retinal fluorescence signal generated in response to the excitation light, the image capture device including:
a filter that reduces background wavelengths from the retina fluorescence signal; and
an image intensifier adapted to increase the retinal fluorescence signal strength.
2. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the excitation light source is a mercury lamp.
3. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the excitation light source is a laser.
4. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the excitation light is aligned with the retina using a dichroic reflector.
5. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the excitation light is aligned with the retina using a fiber optic system.

6. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the image capture device is a charged coupled device.
7. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the image capture device is a still camera.
8. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the image capture device is a cooled charged coupled device camera.
9. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the image intensifier includes a gain factor of at least 100.
10. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the image capture device has a field of view sized to capture a single image of the retinal fluorescence signal generated by the retina.
11. The device for measuring the auto-fluorescence of a retina of claim 1, further comprising a processor programmed to analyze the retinal fluorescence signal with respect to a second stored retinal fluorescence signal.
12. The device for measuring the auto-fluorescence of a retina of claim 1, further comprising a processor programmed to analyze the retinal fluorescence signal to determine a contrast change.
13. The device for measuring the auto-fluorescence of a retina of claim 12, wherein the processor is programmed to analyze the retinal fluorescence signal to determine a local contrast change.

14. The device for measuring the auto-fluorescence of a retina of claim 12, wherein the processor is programmed to analyze the retinal fluorescence signal to determine a rate of contrast change.
15. The device for measuring the auto-fluorescence of a retina of claim 1, wherein the filter reduces wavelengths beyond those associated with flavoprotein auto-fluorescence.
16. A method of non-invasively measuring the metabolic activity of a retina, the method comprising:
 - aligning an image detection device with the subject retina;
 - aligning an excitation light source with the subject retina;
 - providing an excitation light generated by the excitation light source to induce retinal auto-fluorescence in the subject retina;
 - capturing a single image representing the induced retinal auto-fluorescence;
 - intensifying the single image to increase the signal strength of the retinal auto-fluorescence; and
 - analyzing the single image to determine a contrast.
17. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein aligning the excitation light source includes aligning a dichroic reflector to direct the excitation light towards the subject retina.
18. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein aligning the excitation light source includes aligning a fiber optic system to direct the excitation light towards the subject retina.

19. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein aligning the image detecting device includes aligning a charged coupled device camera.
20. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein aligning the image detecting device includes aligning a still camera.
21. The method of non-invasively measuring metabolic activity of a retina of claim 20, wherein aligning the image detecting device includes aligning an image intensifier.
22. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein aligning the excitation light source includes generating the excitation light at an excitation wavelength of about 450nm.
23. The method of non-invasively measuring metabolic activity of a retina of claim 16, further including reducing the amount of ambient light presented to the subject retina.
24. The method of non-invasively measuring metabolic activity of a retina of claim 16, further including filtering the induced retinal auto-fluorescence beyond the wavelengths associated with flavoprotein auto-fluorescence.
25. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein capturing a single image includes capturing an image representative of the auto-fluorescence specific to flavoproteins.

26. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein analyzing the single image comparing the single image with a second stored single image.
27. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein analyzing the single image includes determining a local contrast change.
28. The method of non-invasively measuring metabolic activity of a retina of claim 16, wherein analyzing the single image includes determining a rate of contrast change.
29. The method of non-invasively measuring metabolic activity of a retina of claim 16, further including aligning at least one objective lens between the image detection device and the subject retina.
30. A method of upgrading a standard imaging device to non-invasively measure the metabolic activity of a retina, the method comprising:
replacing a standard light source with an excitation light source for
generating a filtered excitation light;
positioning an image detection device to detect a single image
representing a retinal auto-fluorescence generated in
response to the filtered excitation light; and
increasing the intensity of the single image using an intensifier.
31. The method of upgrading a standard imaging device of claim 30, further comprising positioning a filter between the image detection device and a subject retina to prevent detection of wavelengths beyond those associated with flavoprotein auto-fluorescence.

32. The method of upgrading a standard imaging device of claim 30, wherein providing the excitation light source includes providing a mercury lamp.
33. The method of upgrading a standard imaging device of claim 30, wherein providing the excitation light source includes providing a laser.
34. The method of upgrading a standard imaging device of claim 30, wherein generating the filtered excitation light includes producing light at a wavelength of about 450nm.
35. The method of upgrading a standard imaging device of claim 30, further comprising positioning at least one objective lens to scale the detected single image.